END SEMESTER EXAMINATION MAY-2024

Course Name: - B.Tech(CSE, CE, EE, ECE, ME) **Semester:- 2^{nd}**

Paper Name: - Engineering Mathematics-II **Paper Code:- TBS-202**

Time - 3 Hrs + 20 minutes per hour extra time for V.I. & examinees with writer. **Max Marks-70**

समय– 3 घण्टे + 20 मिनट प्रति घंटे अतिरिक्त–दृष्टिबाधित एवं सह लेखक परीक्षार्थियों के लिए। अधिकतम अंक–70

Instructions:

- The question paper consists of three sections namely A, B, C. All sections are compulsory.
- Section A- Each question carries 3 mark. All questions are compulsory.
- Section B- Answer any 5 out of 6 given questions in maximum hundred (150) words. Each question carries 7 marks.
- Section C- Answer any 2 out of 3 given questions in maximum five hundred (500) words. Each question carries 10 marks.

निर्देश:

- प्रश्न पत्र में तीन खण्ड अ, ब, व स हैं। सभी खण्ड अनिवार्य हैं।
- खण्ड–अ में प्रत्येक प्रश्न तीन अंक का है। सभी प्रश्न अनिवार्य हैं।
- खण्ड–ब में छः प्रश्नों में से किन्हीं पाँच प्रश्नों के उत्तर अधिकतम 150 शब्दों में दें। प्रत्येक प्रश्न सात अंक का है।
- खण्ड–स में तीन प्रश्नों में से किन्हीं दो प्रश्नों के उत्तर अधिकतम (300) शब्दों में दें। प्रत्येक प्रश्न 10 अंक का है।

Section – A (खण्ड–अ)

Objective Questions(वस्तुनिष्ठ प्रश्न)

1. Answer all the following questions. 5×3 =15

निम्नलिखित सभी प्रश्न अनिवार्य हैं।

i) The partial differential equation $y\frac{\partial^2 u}{\partial x^2} + 2x\frac{\partial^2 u}{\partial x \partial y} + y\frac{\partial^2 u}{\partial y^2} = 0$ is elliptic if

a) $x^2 = y^2$
b) $x^2 < y^2$
c) $x^2 + y^2 > 1$
d) $x^2 + y^2 = 1$

ii) Form the partial differential equation of the function $f(x + y + z,\ x^2 + y^2 + z^2)$

a) $(y - z)p + (z - x)q = x - y$
b) $(y + z)p - (z + x)q = x + y$
c) $2z = xp + yq$
d) None of these

iii) Laplace transform of a function F(t) is $\frac{2}{(s-a)^2+4}$ then F(t) is

a) $e^{at}\cos 2t$
b) $e^{at}\sin 2t$
c) $e^{2t}\cos at$
d) $e^{2t}\sin at$

iv) Inverse Fourier transform of a function $F(s)$ is

a) $f(x) = \frac{1}{\sqrt{2\pi}}\int_0^\infty e^{-isx}.F(s)\,ds$
b) $f(x) = \frac{1}{\sqrt{2\pi}}\int_{-\infty}^\infty e^{-isx}.F(s)\,ds$
c) $f(x) = \sqrt{\frac{2}{\pi}}\int_0^\infty e^{-isx}.F(s)\,ds$
d) $f(x) = \sqrt{\frac{2}{\pi}}\int_{-\infty}^\infty e^{-isx}.F(s)\,ds$

v) Which one is wrong recurrence relation for Bessel's function $J_n(x)$

a) $\frac{d}{dx}[x^n J_n(x)] = x^n J_{n-1}(x)$

b) $\frac{d}{dx}[x^{-n} J_n(x)] = -x^{-n} J_{n+1}(x)$

c) $\frac{d}{dx}[x^{-n} J_n(x)] = x^{-n} J_{n+1}(x)$

d) $J_n(x) = \frac{x}{2n}[J_{n-1}(x) + J_{n+1}(x)]$

Section – B (खण्ड–ब)
Short Answer Questions (लघुउत्तरीय प्रश्न)

2. Answer any five of the following questions in maximum 150 words. **5×7=35**
निम्नलिखित में से किन्हीं पाँच प्रश्नों के उत्तर अधिकतम 150 शब्दों में दें।

i. Find the Fourier series for $f(x) = 4 - x^2, -2 \le x \le 2$.

ii. Find the Fourier transform of e^{-ax^2}.

iii. Prove that n is integer the Bessel's functions $J_n(x)$ & $J_{-n}(x)$ are linearly dependent & $J_{-n}(x) = (-1)^n J_n$.

iv. Solve $r - 3s + 2t = e^{2x-y} + e^{x+y} + cos(x + 2y)$.

v. The vibrations of an elastic string is governed by the partial differential equation $\frac{\partial^2 u}{\partial t^2} = \frac{\partial^2 u}{\partial x^2}$. The length of string is π and the ends are fixed. The initial velocity is zero and the initial deflection is $u(x, 0) = 2(sinx + sin3x)$. Find the deflection $u(x, t)$ of the vibrating string for $t \ge 0$.

vi. Find the inverse Laplace transform of $\frac{6}{2s-3} - \frac{3+4s}{9s^2-16} + \frac{8-6s}{16s^2+9}$.

vii. Solve $y'' + 3y' + 2y = te^{-t}$, $y(0) = 1$, $y'(0) = 0$ by using Laplace transform.

Section – C (खण्ड–स)
Descriptive Questions (विवरणात्मक प्रश्न)

3. Answer any two of the following question in maximum 300 words. **2×10=20**
निम्नलिखित में से किन्हीं दो प्रश्नों के उत्तर अधिकतम 300 शब्दों में दें।

i) **(a)** Show that $\frac{d}{dx}[xJ_n J_{n+1}] = x[J^2 - J_{n+1}^2]$

(b) Find the solution of wave equation $\frac{\partial^2 y}{\partial t^2} = c^2 \frac{\partial^2 y}{\partial x^2}$ such that $y = P_0 \cos pt$ (P_0 is a constant), when $x = l$ & $y = 0$ when $x = 0$.

ii) **(a)** Find the inverse Laplace transform of $\frac{3}{s-2} + \frac{6}{9s^4} + \frac{2s}{s^2+25}$.

(b) Find the general solution of $x(z^2 - y^2)p + y(x^2 - z^2)q = z(y^2 - x^2)$.

iii) **(a)** Find the Fourier Sine transform of e^{-ax}.

(b) Solve $(mz - ny)p + (nx - lz)q = ly - mx$.